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SHORT PAPER

WILEY

Effects of wakeful resting versus social media usage after learning on the retention of new memories

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Summary

Communication and information sharing via social media platforms is a common and popular activity. The majority of existing studies indicate that social media usage has detrimental effects on learning and memory. However, it is an open question as to whether social media usage affects memory even after learning. To test this, healthy young adults learned and immediately recalled a vocabulary list. Subsequent to recall, participants either wakefully rested for 8 min or used social media for 8 min. A delayed recall test took place after the wakeful resting condition and the social media condition and again after 1 day. Our results showed that social media usage, compared with wakeful resting, had detrimental effects on memory performance over both retention intervals. We assume that social media usage interfered with memory consolidation of learned vocabularies and suggest that learners opt for wakeful resting over social media usage as a learning-break activity.

KEYWORDS

consolidation, interference, memory retention, social media, wakeful resting

1 | BACKGROUND

Social media platforms (e.g., Facebook and Instagram) enable us to communicate and share information via texts, images, and videos on an instantaneous basis every second of our life. Scientists are interested in how social media usage influences human cognition and behaviour. Previous studies have found negative correlations between social media usage and academic performance (Junco, 2012; Kirschner & Karpinski, 2010), hours per week spent studying (Rosen, Mark, & Cheever, 2013), free recall performance (Frein, Jones, & Gerow, 2013), and self-reported attentional span (Paul, Baker, & Cochran, 2012). Studies on media multitasking, that is, simultaneously engaging in two or more types of media and using media while engaging in nonmedia activities (van der Schuur, Baumgartner, Sumter, & Valkenburg, 2015), often revealed negative relationships between working memory, long-term memory, and cognitive control (Ophir, Nass, & Wagner, 2009; Uncapher, Thieu, & Wagner, 2016), whereas researchers found positive relationships with multisensory integration (Lui & Wong, 2012). In sum, the majority of studies showed that (social) media usage has detrimental effects on learning and memory.

To our knowledge, whether social media affects memory when used after learning has not yet been investigated. The period immediately after learning plays an essential role in memory formation (Dudai, Karni, & Born, 2015; Müller & Pilzecker, 1900). For instance, studies manipulating the phase immediately after learning found increased forgetting when participants were involved in task-related cognitive and sensory engagement after learning, compared to brief periods of wakeful resting, where participants were asked to quietly rest with their eyes closed (Brokaw et al., 2016; Dewar, Alber, Butler, Cowan, & Della Sala, 2012; Dewar, Cowan, & Della Sala, 2007). This

effect was found multiple times with different learning materials (visuospatial and verbal; Craig, Dewar, Della Sala, & Wolbers, 2015; Dewar et al., 2012) and postencoding distractor material (games, spot-the-difference, vocabulary learning, and tone-detection tasks; Brokaw et al., 2016; Dewar et al., 2007; Mercer, 2015), in different populations (older adults: Dewar et al., 2012; younger adults: Dewar et al., 2007; and children: Fatania & Mercer, 2017), as well as over different retention intervals (minutes to days; Dewar et al., 2012; Dewar et al., 2007).

Explanations for the detrimental effects of ongoing task-related cognitive and sensory engagement after learning can be found in neuroscientific concepts. The term "memory consolidation" refers to a family of neural processes relevant for transforming new information into longer lasting representations—recallable after minutes, days, and even years (Dudai et al., 2015). Memory consolidation has been related to brain activity and connectivity within and between learning-relevant brain areas during wakeful resting. For instance, Tambini, Ketz, and Davachi (2010) found enhanced functional connectivity between the hippocampus and neocortical regions during wakeful resting (~8 min) following an associative memory task with high subsequent memory, compared with pretask baseline wakeful resting connectivity. One relevant consolidation process represents neural replay. Neural replay can be described as reactivation of recent experiences (e.g., in the hippocampus), whereby this activity relates to later memory (Deuker et al., 2013; Dudai et al., 2015; Peigneux et al., 2006; Robertson, 2012; Schapiro, McDevitt, Rogers, Mednick, & Norman, 2018; Tambini et al., 2010). It is suggested that neural replay can take place during different states of reduced encoding, sensory input, and internal thought processes, like wakeful resting, slow-wave sleep, or similar states brought about by, for instance, benzodiazepines and alcohol (Inostroza & Born, 2013; Mednick, Cai, Shuman, Anagnostaras, & Wixted, 2011; Wixted, 2005). It is assumed that when consolidation processes are inhibited, through task-related cognition and sensory engagement to new information, memory performance at a later time is decreased (Dewar et al., 2007; Dudai et al., 2015; McGaugh, 2015; Robertson, 2012). The impact of those interfering processes after learning seems thereby to lessen gradually, meaning that the higher the temporal proximity between learning and subsequent interference, the lower the impact of this interference on the to-be-maintained learning material, and vice versa (Dewar, Garcia, Cowan, & Della Sala, 2009; Robertson, 2012; Wixted, 2005).

In the present study, we investigated the impact of wakeful resting compared with social media usage after learning on memory. We asked participants to learn and immediately recall a list of vocabulary words. The critical manipulation, then, took place immediately after recall. We required the participants to use a social media platform (Facebook or Instagram; see Section 2) for 8 min or to wakefully rest for 8 min. A delayed recall test took place after the wakeful resting condition and the social media condition and again after 1 day. The examiner prompted the participants with questions regarding arousal, valence, and rehearsal at different times. On the basis of the outline above that consolidation interference can be induced by ongoing sensory input and cognitive engagement (e.g., Craig et al., 2015; Dewar et al., 2012; Mercer, 2015) and that social media usage involving viewing photos, reading text, and watching films involves ongoing sensory and cognitive engagement, we hypothesised that participants would retain more words in the wakeful resting condition than in the social media condition (Brokaw et al., 2016; Craig et al., 2015; Dewar et al., 2007; Dewar et al., 2012; Dewar, Alber, Cowan, & Della Sala, 2014; Mercer, 2015).

2 | METHODS

2.1 | Participants

Sixty-seven university students (43 female and 24 male; mean age = 22.09 years, *SD* = 2.71 years, age range = 18–32 years) participated in the study in exchange for course credit (a priori power analysis was conducted with G*Power; Faul, Erdfelder, Buchner, & Lang, 2009; repeated measures analysis of variance [within–between interaction]: effect size *f*: .25, α: .05, total sample size: 54, actual power: .95). We randomly assigned participants to one of two experimental conditions: 33 participants (24 female, mean age = 21.55 years, *SD* = 2.29 years, age range = 19–29 years) were assigned to the wakeful resting condition and 34 participants (19 female, mean age = 22.62 years, *SD* = 3.01 years, age range = 18–32 years) were assigned to the social media condition.

2.2 | Procedure and materials

We based our study design on that of Mercer (2015), where they found that 8 min of wakeful resting supported participants' memory retention of Icelandic–English word associations more so than did working on a different task (learning Norwegian–English word pairs or face pairs). Our study included two experimental sessions, which we separated by 1 day. In Session 1, we asked native German participants to learn 20 Icelandic–German word pairs (Mercer, 2015). We presented pseudo-randomised word pairs sequentially for 5 s each. Between the word-pair presentations, we presented a fixation cross for 3 s. We instructed participants to memorise the word pairs for a recall test immediately following the task. During recall, we presented the 20 previously learned Icelandic words in written form on a sheet of paper in a randomised order for each participant. We then asked the participants to write down the German translations they remembered within a time limit of 3 min (Mercer, 2015). No participant was familiar with the Icelandic language.

Following the immediate recall test, participants either wakefully rested or used social media. In the wakeful resting condition, we asked participants to lay their heads on their arms, close their eyes, and rest quietly for 8 min. At the beginning of the social media condition, we asked the participants whether their smartphones were charged and whether they have Facebook and/or Instagram installed on their devices. This was the case for all participants. We assumed Facebook and Instagram to be two of the most frequently used

social media platforms by college students during learning breaks. Facebook and Instagram are used for, among other things, social purposes (e.g., communicating with friends and sharing relevant information), self-displaying (e.g., taking photos and videos of specific life moments), and entertainment (e.g., consuming generated photos, videos, and text of others; Cheung, Chiu, & Lee, 2011; Sheldon & Bryant, 2016). Recent statistics for the United States about social media behaviour showed that about 68% of adults reported that they use Facebook, three-quarters of whom do so on a daily basis (Pew Research Center, 2018; Statista, 2018). Statista (2018) suggests that Instagram is the most popular social media platform among younger adults, with 64% of 18- to 29-year-old adults using it. In our study, we instructed participants only to use either Facebook or Instagram in a way they would use it outside the laboratory. To increase ecological validity and task involvement, we additionally allowed participants to go into posts, comments, and likes but not to follow external links. Social media usage involves ongoing sensory and cognitive engagement that includes viewing photos, reading text, and watching films, activities that should have detrimental effects on memory consolidation (see Dewar et al., 2007). Participants in our study used social media for 8 min. Participants were instructed to use social media without tone and in silence.

At the end of Session 1, and again in Session 2 (after 1 day), a free recall test took place. We did not announce either of the delayed recall tests. In each of the two recall tests, we presented the 20 newly learned Icelandic words on a sheet of paper and asked participants to write down as many of the German translations as possible within 3 min. We pseudo-randomly mixed the order of presented Icelandic words for each participant and recall time (immediate, first delayed, and second delayed).

In both experimental conditions, the experimenter was always in the laboratory and rested/used social media together with the participants, in order to ensure a more controlled setting (e.g., compliance of instructions). Prior to the word-pair presentation, and again immediately after the wakeful resting condition/social media condition, we asked participants for their arousal and valence states (see Table 1). Immediately after the wakeful resting condition/social media condition, we also asked whether participants had consciously rehearsed the words during the rest condition/social media condition (see Table 1). In each session, participants had (white) partitions to their right and left, which were constructed such that the end of each partition was about 20 in. longer than the table. We assumed that the partitions would help to optimise (a) the learning condition (e.g., enabling the participants to be more focused on the learning stimuli than on their desk neighbour), (b) the recall test condition (shielding each participant's recalled words, to minimising copying), and (c) the wakeful resting condition/social media condition itself (more privacy, increased level of relaxation, and minimising distraction from, e.g., their desk neighbour). The experimenter also sat behind a partition so that participants did not feel like they were being observed and so that the experimenter's presence would not distract them.

We tested between 1 and 10 participants per session. We programmed the experimental procedure using the experimental software PsychoPy (3.0.0; font colour: white; background colour: black; font type: Arial; letter height: 0.3). Prior to the experiment, we closed the shutters and turned on the lights. During the wakeful resting phase, we turned off the lights to reduce sensory input and to increase relaxation. No participant indicated falling asleep during the wakeful resting condition. Sessions 1 and 2 took place in the same room and always between 9 a.m. and 12 a.m.

TABLE 1 Descriptive statistics for correctly recalled words, rehearsal, arousal, and valence separately for the wakeful resting condition and social media condition

	Wakeful resting	Social media
Measures	**Mean (*SD*)**	**Mean (*SD*)**
Correctly recalled words		
Immediate recall	7.64 (3.52)	7.21 (2.73)
First delayed recall after 8 min	7.55 (3.27)	6.65 (2.81)
Second delayed recall after 1 day	7.36 (3.30)	6.29 (3.09)
Rehearsal[a]		
Thought about words	2.33 (1.41)	1.71 (0.97)
Consciously rehearsed words	1.67 (1.11)	1.27 (0.67)
Arousal[b]		
Prior to learning	3.67 (1.43)	3.71 (1.38)
After post-learning condition	2.39 (1.22)	3.06 (1.43)
Valence[c]		
Prior to learning	5.21 (1.14)	4.74 (1.52)
After post-learning condition	5.27 (1.18)	4.62 (1.37)

[a]How often did you thought about/consciously rehearse the words in the previous social media condition/wakeful resting condition? (1 = *not at all* to 7 = *very often*).
[b]I feel: 1 = *calm*, *relaxed*, *sleepy* to 7 = *activated*, *stimulated*, *wide awake*.
[c]I feel: 1 = *dissatisfied*, *melancholic*, *unhappy* to 7 = *cheerful*, *satisfied*, *happy*.

2.3 | Scoring

Our measure of participants' memory performance was the sum of correctly recalled German words (out of 20 total words) in the respective recall test (immediate, after 8 min, and after 1 day). To examine how much of the immediately recalled words were retained after a short delay (8 min) and long delay (1 day), we computed for each participant a retention score for the short delay recall and long delay recall—separately for the wakeful resting condition and social media condition. We calculated the retention scores by dividing the sum of correctly recalled German words after a given delay by the sum of correctly recalled German words at immediate recall.

3 | RESULTS

The alpha level was set at <.05. Table 1 shows the descriptive statistics of correctly recalled words. A *t* test analysis showed no differences

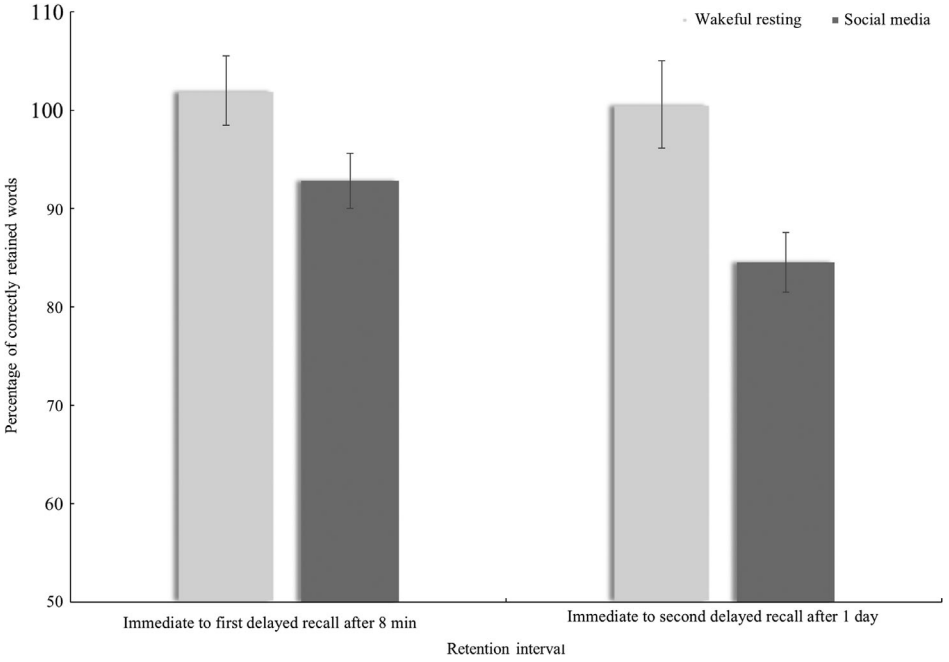

FIGURE 1 Percentage of correctly retained words over a retention interval of 8 min and 1 day plotted separately for the wakeful resting condition and the social media condition. Error bars represent standard errors of the mean

between immediate recall performance in the wakeful resting condition and the social media condition, $t(65) = -.56$, $p = .577$. A t test analysis of the proportion of words retained between the immediate recall test and the 8-min delayed recall test showed increased forgetting in the social media condition compared with the wakeful resting condition, $t(65) = -2.05$, $p = .045$, $d = -0.500$ ($U = 413.50$, $p = .049$, $r_{rb} = -.263$; Figure 1). A t test analysis of the proportion of words retained between the immediate recall test and the 1-day delayed recall test showed increased forgetting in the social media condition compared with the wakeful resting condition, $t(65) = -3.00$, $p = .004$, $d = -0.734$ ($U = 344.00$, $p = .005$, $r_{rb} = -.387$).[1] A t test analysis of the proportion of words retained between the 8-min delayed recall test and the 1-day delayed recall test showed no significant differences between the social media condition and the wakeful resting condition, $t(65) = -1.69$, $p = .095$, $d = -0.414$ ($U = 455.00$, $p = .153$, $r_{rb} = -.189$). Including group size as a covariate did not change our findings ($ps > .10$). These results indicate that forgetting was increased in the social media condition compared with the wakeful resting condition.

In reference to the maximum Likert scale score, subjective mean rating scores for the questions on whether participants thought about the previously learned words and whether participants consciously rehearsed the previously learned words were low (Table 1). A t test analysis revealed that participants in the wakeful resting condition thought about the words more often than participants in the social media condition, $t(65) = -2.13$, $p = .037$, $d = -0.521$ ($U = 399.00$, $p = .030$, $r_{rb} = -.289$). No significant differences between the delay conditions were found for the question addressing whether participants consciously rehearsed the previously learned words, $t(65) = -1.81$, $p = .076$, $d = 0.441$ ($U = 451.00$, $p = .077$, $r_{rb} = -.196$). Spearman correlations revealed that thinking about the words and conscious rehearsal of the words were not significantly correlated with the proportion of words retained between the immediate and 8-min delayed recall tests, ($r < .10$, $p > .70$), as well as the proportion of words retained between the immediate and 1-day delayed recall tests, ($r < .17$, $p > .10$).

Subsequently, we analysed participants' responses to the arousal and valence questions (Table 1). We conducted repeated measures analyses of variance with the time of the arousal/valence question (prior to learning, after the respective delay condition) as a within-subject factor and condition (wakeful resting, social media usage) as a between-subject factor. For the arousal question, we found a significant main effect for the time of the arousal question, $F(1, 65) = 49.95$, $p < .001$, $\eta^2 = .109$, and a nonsignificant main effect for condition, $F(1, 65) = 1.32$, $p = .254$, $\eta^2 = .020$. The time of the arousal question*condition interaction was significant, $F(1, 65) = 5.31$, $p = .024$, $\eta^2 = .012$. For the valence question, we found no significant main effect for the time of the valence question, $F(1, 65) = .10$, $p = .753$, $\eta^2 < .001$. The main effect of condition did not reach the significance level, $F(1, 65) = 3.19$, $p = .071$, $\eta^2 = .049$. The time of the valence question*condition interaction was not significant, $F(1, 65) = .98$, $p = .327$, $\eta^2 = .001$. Spearman correlations in the wakeful resting condition regarding the responses to the arousal question prior to learning were significantly negative related to the proportion of words retained between the immediate recall test and the 8-min delayed recall test, $r = .34$, $p = .026$. Other correlations between the time of arousal/valence questions and the proportion of words retained between the immediate and 8-min/1-day recall tests in the respective delay conditions were not significant, $p > .10$.

4 | DISCUSSION

In the current study, we investigated whether wakeful resting compared with social media usage after learning affects memory for

Icelandic–German vocabularies. Our results showed that participants who used social media after learning recalled fewer German translations in a delayed recall test after 8 min and then 1 day, compared with participants who wakefully rested for 8 min after learning. These results support findings from social media studies showing negative relationships between social media usage, learning, and memory performance (Frein et al., 2013; Junco, 2012; Kirschner & Karpinski, 2010; Rosen et al., 2013). Moreover, our results support findings showing that wakeful resting after learning in contrast with ongoing sensory input and task-related cognitive engagement, for example, searching for errors in pictures and playing a game (Brokaw et al., 2016; Craig et al., 2015; Dewar et al., 2007; Dewar et al., 2012), reduces forgetting. Most importantly, our results extend both lines of research by showing that (a) social media usage after learning increases forgetting more than does wakeful resting and (b) this effect endures over both a shorter and a longer retention interval and is not recovered by a period of overnight sleep (Alber, Della Sala, & Dewar, 2014; Craig et al., 2015; Dewar et al., 2012).

Possible reasons for differences in the impact of wakeful resting and social media usage after learning can be discussed in light of several partially overlapping explanations. It is conceivable that the higher retention scores among participants in the wakeful resting condition were the result of higher rehearsal rates, compared with those in the social media condition where rehearsal processes were likely to be fewer or inhibited (see Peterson & Peterson, 1959). However, participants in our study reported that they rarely rehearsed the vocabulary words, with no differences between those in the wakeful resting condition and those in the social media condition; moreover, we found no relationship between conditions and the proportions of words retained. These subjective reports indicate that memory consolidation processes were active during wakeful resting and that rehearsal probably played a minor role, which is in line with Dewar et al.'s (2014) findings showing that higher memory retention in a wakeful resting condition is dependent not on intentional rehearsal of learned material but on superior memory consolidation.

It could be argued that the participants in the current study retained more words in the wakeful resting condition because of reduced retrieval competition at delayed recall. However, in our view, at least three potential explanations speak against this view: (a) No (native German) participant indicated having learned Icelandic, minimising the probability that they had processed or at least read Icelandic content during the social media phase that could have interfered with the learning material; (b) Instagram especially is strongly visually oriented, meaning that primarily, pictures and videos are viewed, which should have interfered with the verbal learning material to a lesser extent; and (c) the wakeful resting effect was still found after a day, countering possible arguments that a wakeful resting period could have temporally isolated memory traces of the vocabulary lists from interference thereby rendering them more distinguishable and easier to retrieve (Brown, Neath, & Chater, 2007; Ecker, Brown, & Lewandowsky, 2015), as vocabulary lists in both delay conditions should have become indistinguishable to a similar extent over the long term.

We assume that our findings were the result of superior memory consolidation that took place during the 8-min wakeful resting period (Craig et al., 2015; Dewar et al., 2012; Dudai et al., 2015; Wixted, 2005). Neuroscientific studies suggest that learners tend to continue processing learned information offline and that enhanced correlations during rest between brain areas that are relevant to the learning itself are related to how much information is remembered (Dudai et al., 2015; Karlsson & Frank, 2009; Robertson, 2012; Tambini et al., 2010). During states like wakeful resting, new information encoding and sensory input are reduced. Thus, it can be assumed that when we put ourselves in such a condition immediately after learning, consolidation processes like neural replay are released, and subsequently, new memories are strengthened. This release of consolidation processes is probably initiated by a switch to a different neural state during resting—for example, to a slow oscillatory brain activity, which is related to sleep-based memory consolidation (Brokaw et al., 2016; see also Mednick et al., 2011). When we use social media, we watch videos and pictures, read texts, and make various decisions (e.g., "I like this post"). Ongoing cognitive processes during this phase share similarities with distractor tasks used in other wakeful resting studies, for example, playing a game (Brokaw et al., 2016), processing of concrete sounds (Craig, Della Sala, & Dewar, 2014), searching errors in pictures (Dewar et al., 2007), and learning of word and face associations (Mercer, 2015). Ongoing sensory input and encoding of novel stimuli during these activities appear to block or reduce consolidation processes that are relevant for stabilising previously learned memory content, and this leads to worse memory retention compared with that following a wakeful resting phase.

Another possible explanation is that the (emotional) arousal state during the wakeful resting condition and social media condition (e.g., low [emotional] arousal during wakeful resting and high [emotional] arousal during social media usage) had a modulating effect on memory retention (McGaugh, 2015). In our study, the reports of participants' arousal states showed that arousal levels decreased over time in both conditions but significantly more so in the wakeful resting condition. In their arousal-biased competition model, Mather and Sutherland (2011) proposed an interesting view, postulating that "arousal (whether elicited by external stimuli, internal thoughts, or stress hormones) modulates the strength of competing mental representations, enhancing memory for items that dominate the contest for selective attention" (p. 114). Arousal can enhance memory consolidation for the most conspicuous or goal-relevant stimuli, regardless of whether those stimuli are arousing. According to this view, high-priority stimuli are enhanced, and low-priority stimuli are impaired for memory consolidation. It is conceivable that our participants gave higher priority to the social media content than to the vocabulary words, resulting in retrograde impairment of the vocabularies and, consequently, lower memory retention performance in the social media condition than in the wakeful resting condition. The higher priority given to the social media content may have been induced through images, texts, and videos, as well as "likes" for participants' own postings, which seem to activate areas of the brain's reward system (Meshi, Morawetz, & Heekeren, 2013; Sherman, Payton, Hernandez, Greenfield, & Dapretto, 2016).

Several limitations must be noted. First, in our study, the experimenter engaged in the same activity as the participants. Therefore, we had no full control over what exactly participants were doing during the social media phase, for example, whether they visited other Internet sites. Second, and related to the first point, we do not know how participants used the social media platforms. Accordingly, it could be assumed that individual differences in social media usage might account for individual differences in memory performance. Third, for this study, we assumed that any type of postlearning activity involving ongoing cognitive engagement and sensory input interferes with memory consolidation (see Dewar et al., 2007).

Wakeful resting studies have shown that "specific interference," such as verbal distractors subsequent to verbal learning (Müller & Pilzecker, 1900), and "non-specific interference," such as visuospatial distractors subsequent to visuospatial learning (Dewar et al., 2007), appear to have detrimental effects on the retention of new memories over shorter and longer temporal maintenance intervals. However, despite many studies showing that task-related cognitive and sensory engagement after learning increases forgetting, conflicting results also exist. For instance, Varma et al. (2017) found no differences in forgetting rates when researchers asked participants to wakefully rest after encoding, compared with participants who worked on a two-back task or even on a cognitively more effortful three-back task. Similarly, Martini, Riedlsperger, Maran, and Sachse (2017) found no differences between wakeful resting and task-related cognitive engagement when they asked participants to encode texts in their second language, independent of whether participants were involved in a verbal (reading a newspaper article) or visuospatial (finding errors in pictures) filler task after encoding (see also Fatania & Mercer, 2017; Martini, Zamarian, Sachse, Martini, & Delazer, 2018). These results suggest that under certain conditions, task-related cognitive and sensory engagement compared with wakefully resting do not differ in their impact on memory. Thus, which of the various social media-related cognitive processes potentially moderated the detrimental effects of social media usage on memory—and whether cognitive processes vary in their detrimental effect on memory—remains an open question.

Finally, our measurements of rehearsal rates as well as arousal and valence states have to be viewed cautiously. We need more comprehensive and specific measures to assess these constructs in the context of wakeful resting and social media usage. For instance, regarding our questions on rehearsal, we do not know (a) whether the whole learning list was repeated or where only specific parts were repeated; or (b) the exact time the word pairs were rehearsed (e.g., at the beginning or end of the resting phase). Additionally, the Likert scale used (1 = *not at all*; 7 = *very often*) leaves what participants understood when they reported "repeated very often" and how they interpreted the Likert scale from 2 to 6 open to question. In addition to the experimental manipulation of specific retention-related processes (like the rehearsal rate; Dewar et al., 2014), relating rehearsal, arousal, and valence is relevant to additional measures such as pupillometry, electroencephalograms (Brokaw et al., 2016), neuroimaging (Tambini et al., 2010), heart rate (variability), and skin-conductance responses.

To conclude, we found that participants using social media immediately after a learning activity showed lower retention scores for Icelandic–German word pairs than did participants who wakefully rested after learning. This effect was found over a retention period of 8 min and 1 day. We assume that consolidation interference induced by sensory and cognitive engagement associated with social media usage led to our results. Adolescents and younger adults (e.g., students) are the prime users of social media, which they often use multiple times per day, for example, during classes, lectures, and learning breaks. Knowledge about the impact of social media activities on long-term memory immediately after learning is important for learners, trainers, and parents. On the basis of our results, we suggest that learners opt for wakeful resting over social media usage as a learning-break activity.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

DATA ACCESSIBILITY

The data that support the findings of this study are available from the corresponding author upon reasonable request.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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ENDNOTE

[1] Memory performance of correctly recalled words did not significantly decrease from immediate to 1-day recall in the wakeful resting condition, $t(32) = 1.06$, $p = .299$, $d = 0.18$, but decreased significantly in the social media condition, $t(33) = 5.34$, $p < .001$, $d = 0.92$.

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